

Obtaining Highly Reliable Thin Oxide) in view of Ilardi et al. (U.S. Patent No. 5,466,389) and Kern (Hand Book of Semiconductor wafer cleaning technology) and further in view of Sehested et al. (J.Phys.Chem.) and further in view of Stanford et al. (U.S. Patent No. 5,244,000).

The Office Action states that the Ilardi reference teaches an improved composition for cleaning substrates, the composition comprising nonionic surfactants, an additive such as acetic acid and an oxidizing agent such as hydrogen peroxide. The Office Action further states that the Ilardi reference teaches the use of hydrogen peroxide to remove contaminants but fail to teach ozone to remove contaminants from a substrate. The Office Action concludes that it would have been obvious to one of ordinary skill in the art to replace hydrogen peroxide with ozone because both are functionally equivalent as taught by the Kern reference.

Applicants respectfully disagree with the conclusion of the Office Action and believe that the Ilardi reference, rather than supporting an obviousness rejection, actually shows that the invention, as claimed, is not obvious. First, the Ilardi reference, rather than teaching the current invention, actually teaches away from the current invention. The entire focus of the Ilardi reference is not in the use of hydrogen peroxide as a cleaning agent, as the Office Action contends, but in the removal of hydrogen peroxide and other oxidizing agents. The background of the invention, which the Office Action uses as support, teaches the problems of using hydrogen peroxide. Some examples include:

The presence of hydrogen peroxide in SC-1 formulations imparts an inherent instability to these solutions. Such solutions typically exhibit peroxide half-lives of less than one hour at 70°C. The hydrogen peroxide in the SC-1 solution in the presence of certain metals, particularly copper and iron, becomes unstable and decomposes in rapid exothermic fashion leading to potentially dangerous conditions. The hydrogen peroxide has a low tolerance for metal contamination. Additionally, the decomposed hydrogen peroxide drops the concentration of the hydrogen peroxide leading to the possibility of

silicon etching producing wafers that are not acceptable for IC manufacture. Thus, the decomposed hydrogen peroxide needs to be replenished and this changes the solution composition thereby varying the cleaning properties of the solution. In addition, the inherently high pH of the hydrogen peroxide solution presents undesirable safety and environmental concerns. [Col. 1, lines 31-47]

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It is therefore desirable that an alkaline cleaner solution be available which does not require the presence of hydrogen peroxide, that is, a cleaner composition in which the addition of hydrogen peroxide or other oxidizing agents is optional. More particularly, it is an object of this invention to provide such an alkaline cleaner solution that does not require the presence of hydrogen peroxide or other oxidizing agent yet produces an effective wafer cleaning action without producing undue wafer roughness sufficient to render the wafers unacceptable for IC manufacturing and processing, particularly for high density IC manufacturing. [Col. 2, lines 7-17]

Contrary to the Office Action's assertions, Ilardi does not teach an improved composition for cleaning substrates using an oxidizing agent, such as hydrogen peroxide. Quite the contrary, Ilardi teaches that the object of his invention is "to provide such an alkaline cleaner solution that does not require the presence of hydrogen peroxide or other oxidizing agent" Col. 2, lines 12-13. It is improper to combine the Ilardi reference with Kern where the Ilardi reference teaches away from their combination. *See* M.P.E.P. 2146, *In re Grasselli*, 713 F.2d 731, 743, 218 U.S.P.Q 769, 779 (Fed. Cir. 1983). Specifically, the Ilardi reference teaches away from using hydrogen peroxide or other oxidizing agents for cleaning. Therefore, looking to other references (such as Kern) to teach the substitution of ozone for hydrogen peroxide is improper.

Second, the Ilardi reference actually supports Applicants' argument that the substitution of ozone, in the present context, is not obvious. Ilardi recites, in painstaking detail, the reasons to remove hydrogen peroxide and other oxidizing agents. Those reasons include: (1) its inherent instability; (2) its low tolerance for metal contamination; (3) its requirement to be replenished;

(4) its difficulties in maintaining stable cleaning properties; and (5) its undesirable safety and environmental concerns. Faced with these problems, Ilardi attempts to remove hydrogen peroxide and other oxidizing agents while cleaning – in effect avoiding the problem entirely. If it were so obvious to substitute ozone for hydrogen peroxide, as the Office Action contends, why didn't Ilardi teach (or even hint) to do so? In actuality, the substitution ozone for hydrogen peroxide in this type of cleaning context is not obvious, as evidenced by the steps taken Ilardi to avoid the use of hydrogen peroxide or oxidizing agents altogether.

Third, the proposed modification renders the Ilardi reference unsatisfactory for its intended purpose. As stated in its background, Ilardi seeks to remove hydrogen peroxide or other oxidizing agents in the cleaning composition. Yet, the Office Action seeks to substitute ozone for hydrogen peroxide. This is directly contrary to the teaching in Ilardi, which seeks to remove hydrogen peroxide. If the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984). This is exactly what the Office Action proposes when modifying the Ilardi reference. Thus, Applicants believe that the combination of references cited in the Office Action do not render the claims obvious.



CONCLUSION

If for any reason, the application is not considered to be in condition for allowance on the next Office Action and an interview would be helpful to resolve any remaining issues, the Examiner is requested to contact the undersigned attorney at (312) 913-0001.

Respectfully submitted,

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